Westward Waters

Watch a small snowmelt
sliding its gloss down a snowgum's trunk

it becomes the Murray,
a ditch draining across an old sea-floor,
falling a man's height in a day's march

a plain whose patterns were immense
gridded to one mile blocks,
bend after bend, the pure snow-melt
snaking and queueing its way round mallee dunes,
dirtied where a spring of salt wells milkily in
from salt lakes buried in the old sea sands

past clear lakes of ribbon grass
that nourish duck and perch
—or turned to mud-swill by the carp;
the river-bends, brown water loop upon loop
swirling or sullenly back-eddying,

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under the ageing grey-box forests,
a possum meal snoring in each trunk
past the old peppermint alleys
planted when anything foreign was better

past paddocks that try to sweep over dunes
and end in a blown red curl of sand
—sewered, re-filtered, re-returned
to the great red-gum parks, salt-swallowers,

passing Willandra's tributary that never delivers,
Mungo with its dry fish-bones
and saltbush like glaucous seaweed waving
translucent in heat-sick air

turning south, south, down

till the warm last of the snow-melt dribbles
to the sea near Adelaide.

All poetry Mark O'Connor (a)

DOES IT REALLY MATTER?

A fundamental question facing anyone concerned with ecology is whether, in the end, conservation really matters. Does it matter if Australia's native fauna and flora are squeezed out by landscape changes and introduced species? Does it matter if dozens, hundreds, or even thousands, of large and small animals and plants are pushed into extinction? Can't we get by without them? After all, more than 99 percent of the species that have ever lived are now extinct, and doubtless all those on Earth now — including humans — will one day suffer the same fate.

Most people would find it hard to get passionate about the impending extinction of an endangered native midge, or a species of algae, or a bacterium. Why should we care about the fate of species that are too small for us to see without a microscope, and which are neither furry nor cute? Why should we conserve species that appear to have no immediate economic importance, and that aren't regarded by most as aesthetically pleasing?

WHAT'S A FLOODPLAIN WORTH?

The answer is that conserving such creatures, and the ecosystems they occupy, is important for our own survival and prosperity. Each species plays a role in a system that performs many very valuable, but often undervalued, services for Australians.

The myriads of plants and animals that live on floodplains each play their parts in an ecosystem that has evolved over millions of years to suit Australia's peculiar conditions. The floodplain system keeps rivers clean, it allows animals like native fish to feed and to breed and — very importantly in Australia — it allows inland ecosystems to survive long droughts and great floods, and to recover quickly from them. The medium-term consequences of degrading Australia's floodplains and rivers and making them uninhabitable for native species are already beginning to be obvious (Chapters 11-15). The long-term consequences are unknown, but can be guessed at. They may prove to be dangerous not just for the natural environment, but also for humans.

For example, bacteria that naturally occur in floodplain waters feed on the leaves and other detritus shed by vegetation. They are in turn eaten by larger creatures, and so on up the food chain. During floods this food supply becomes available to fish and other species living in river channels, providing much of the energy and chemical building blocks they need to breed and grow (Chapter 9). Floodplains not only supply food to rivers, they also seed rivers with living organisms, replenishing those washed downstream or eaten. Microorganisms on floodplains also remove potential pollutants from water, maintaining the natural chemical balance of rivers. Such feeding and cleaning services go unnoticed in healthy rivers, but when they are turned off the results may be disastrous.

Rivers stripped of their natural clean-up mechanisms become breeding grounds for undesirable organisms, large and small, and their waters become contaminated with pollutants. Waterborne human and animal diseases flourish in a changed aquatic environment, while problems normally kept in check by natural biological controls burgeon out of control. Obvious Murray-Darling examples are the now-frequent blue-green algal (or cyanobacterial) blooms, which were once rare in inland rivers. The accumulation of modern changes to river ecosystems has tipped the competitive balance in favour of cyanobacteria. Another example is the introduced carp, which thrives in Australia's altered inland rivers (Chapter 14).

Top: The Macquarie Marshes include large areas of reedswamps, water couch meadows, river red gum woodlands and small areas of lignum. They provide habitat for a great variety of wildlife and are a valuable drought refuge. Photos: *David Eastburn, MDBC*

Bottom: Paddle steamer at the Echuca wharf. Vast tracts of river red gum were cut during the late 1800s to fuel the paddle steamers that plied the River Murray, shipping wool from inland stations. Sunken snags were removed and, eventually, locks installed to improve navigability.

Inset: Another victim of European settlement in Australia. This large toolache wallaby, *Macropus greyi*, was last seen in 1939, when the last known individual died in captivity. Photo: *Gould Nature Focus*

CHAPTER 2

To explain the importance of biodiversity, researchers sometimes liken living species to the rivets that hold an aeroplane together. Imagine you were about to board an aircraft, and you noticed workers removing rivets from its wings. No problem, they might explain, an aeroplane doesn't depend on any single rivet for its strength. But how many rivets would you let them take out before you refused to board? Similarly, how many genes, species, and living communities can we afford to lose from Australia's floodplains before the system stops working? The answer is: no-one knows, but Australia's inland rivers are giving clear warning signs that we have already gone too far.

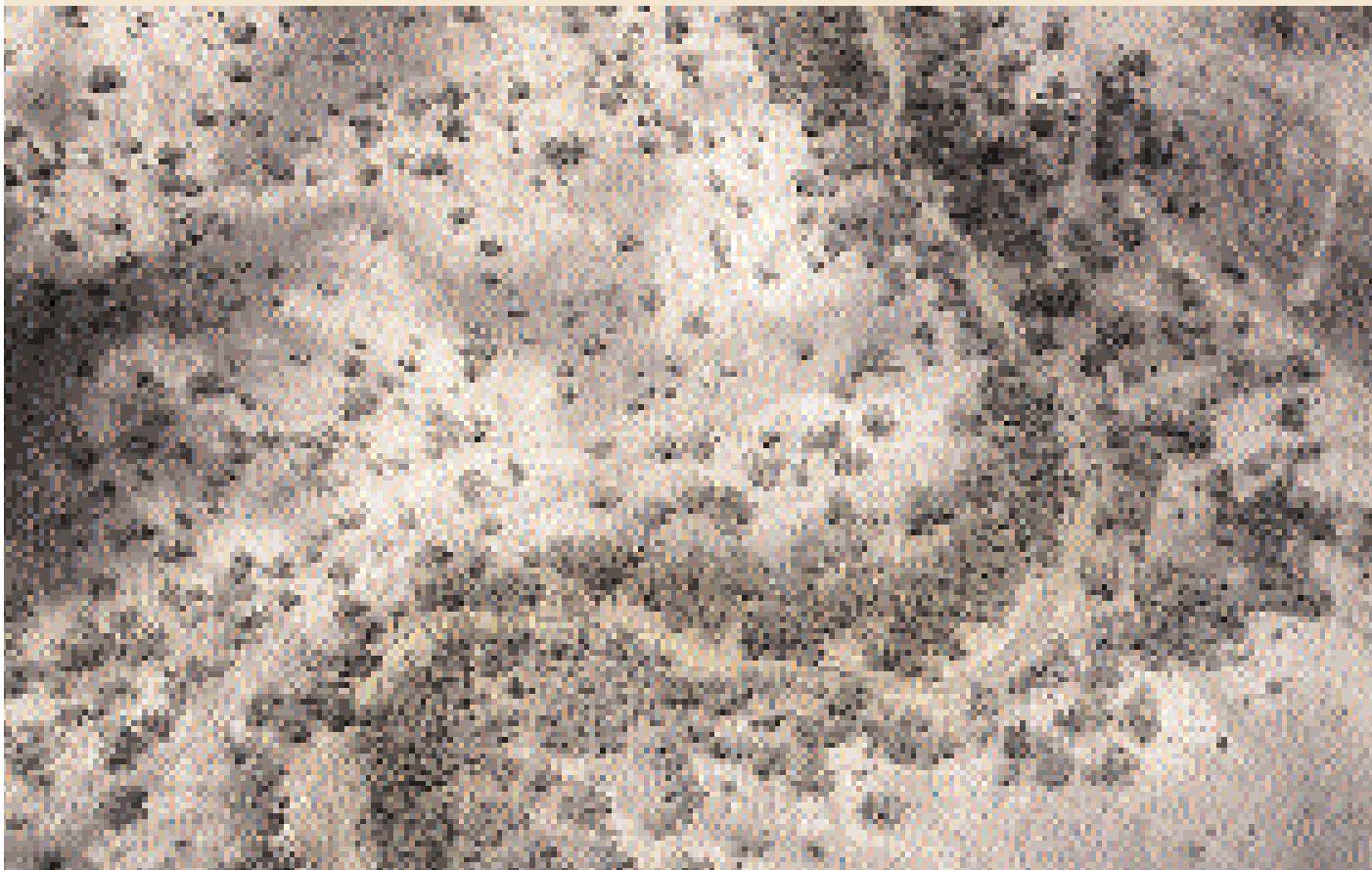
Ecologists have also discovered that some ecosystems depend heavily on one or more 'keystone' species or processes— very important rivets that, if removed, will cause the whole aeroplane to fall apart. And some scientists believe there is a compelling historical precedent in Australia that demonstrates the dangers of tampering with complex ecosystems. They believe that many thousands of years ago early Aborigines hunted to extinction many of the large grazing mammals, such as diprotodons, which once roamed Australia. With the grazers gone, they say, vegetation that would otherwise have been eaten and recycled to the soil as dung became fuel for bushfires. The bushfires killed fire-sensitive plants, and allowed fire-resistant species like eucalypts and wattles to invade large areas of Australia, growing in soils made ever-poorer by regular burning. So by sending just a few species extinct, early humans may have created the impoverished, fire-ravaged landscape of modern Australia. (1)

There are also good commercial reasons for conserving and studying biodiversity. Many of the substances used in medicine and industry were first discovered in living organisms, and all the genetic variants used in agriculture and aquaculture came originally from the wild. For example: six of the world's 20 top-selling medical drugs — including aspirin — are substances first discovered in living species, as are about half the new drugs brought onto the world market each year. The cure for AIDS, or for cancer, might even now be coursing through the blood of a microcrustacean in a floodplain billabong. Losing such unknown genetic diversity is a bit like burning a library without bothering to read the books.

Even very small creatures can turn out to be very useful, or very damaging. A single South American weevil, indistinguishable from its near relatives except for two minuscule grooves on its head visible only under an electron microscope, has saved the world $100 million or more by munching its way through the invasive waterweed Salvinia. The weevil, known only by its scientific name *Cyrtobagous salviniae*, has rescued from ecological collapse many large and economically important lakes and rivers. (2) Similarly, a nematode, a tiny worm-shaped creature that lives in the gut of an insect, saved Australia billions of dollars by helping control the sirex wood wasp pest in pine plantations. (3)

One group of tiny water plants found on floodplains and elsewhere, the floating fern *Azolla*, is already helping alleviate world hunger. Different varieties of azolla grow in shallow, slow moving or still water in Australia and parts of Asia. Blue-green algae (cyanobacteria) living in the fern's leaves capture nitrogen from the air, making it a valuable 'biofertiliser' for paddy rice. The world's leading rice research centre, the Philippines-based International Rice Research Institute (IRRI) sees the fern as such an important living fertiliser that it holds a large collection of different azolla varieties. It makes this collection available free of charge to rice researchers, agricultural extension workers and aid organisations around the world. Among the 562 different azolla varieties kept by IRRI in Manila are 16 from Australia, collected from places such as Griffith, Warwick and Blanchetown. (4).

The Culgoa River near the Queensland–New South Wales border, reduced to a chain of waterholes during a drought. Photo: *David Eastburn, MDBC*



In its natural state, the Murray was quite different from the regulated river we are familiar with today. During severe droughts it was sometimes reduced to a chain of saline waterholes and, in South Australia, sea water infiltrated upstream for up to 250 kilometres from the mouth. This picture was taken near Renmark during the 1914-15 drought. Photo: South Australia *Water Riverland Collection*.

Silver perch is a valued aquaculture species, however, its numbers in the wild have declined dramatically due to habitat degradation and changes to natural flow. Photo: *Gunther Schmida*

Silver perch and yabbies are fast becoming important aquaculture species in Australia and in Asia, but scientific understanding of their behaviour, and of their interactions with other aquatic species, is far from complete. The river red gum is one of the world's most widely grown eucalypts, but its ecological impact on nearby waterways — especially the challenge it presents to decomposers in the aquatic food chain — is still not well understood. There are numerous other examples that demonstrate that conserving and studying floodplain biodiversity has very real economic implications for Australia.

Healthy floodplains: who benefits?

Managing rivers and floodplains for the benefit of humans appears at first to present very different problems from managing them for native species. An irregularly fluctuating system, with natural population booms and die-offs, is clearly not an option for people, or for most modern forms of agriculture. Much of the irrigation infrastructure which has been built along inland river systems has been put there for the express purpose of making the inland flooding and drying cycle less variable and unpredictable, and to change its seasonality.

When Charles Sturt first reached the Darling River in 1829, he found it brackish. During the paddle steamer era, drought often caused flow in the river to fall so low it became unnavigable. In 1883 the paddle steamer PS Jane Eliza was repeatedly stranded on its voyage from Morgan to Bourke, and took three years to complete the journey. (5) By contrast, when the river flooded, vast areas of outback Australia became temporarily accessible to river boats, which steamed out over the paddocks of north-western New South Wales to collect wool cargoes many kilometres from the usual river channel.

Similarly in severe droughts the lower River Murray used to shrink to a chain of saline ponds, while sea water poured in through the Murray Mouth, filling the lower lakes in South Australia and sometimes backing up the river as far as Murray Bridge. In times of drought, early irrigators had to dam the Murray bed with sandbags to provide enough water to pump from. Such extreme dry years were always rare — perhaps only one year in 20 — but if they were allowed to happen now they would be disastrous for the industries that depend on the river systems.

Native species are well-adapted to cope with Australia's variable seasons and climatic extremes. Indeed, many depend on them. Humans, and the agriculture we depend on, are not so well-adapted. Instead we have tried to change the river system to fit our needs.

Modern river managers are faced with an apparent quandary: are the human and environmental needs of a river system fundamentally at odds with each other, or can they be satisfied together? The insight which scientists bring to this argument is that in the long term the prosperity of humans depends on the health of natural systems — that what is good for the environment is also good for people.

Floodplain ecosystems keep rivers clean and alive, and the plants and animals they contain provide insurance against future environmental changes or economic needs. But often it is future generations, not the present one, which will need to claim on that insurance — if they can. And often it is future generations that are being asked to pay the price for present development, because it is they who may inherit a river system whose all-important ecological processes can no longer function.

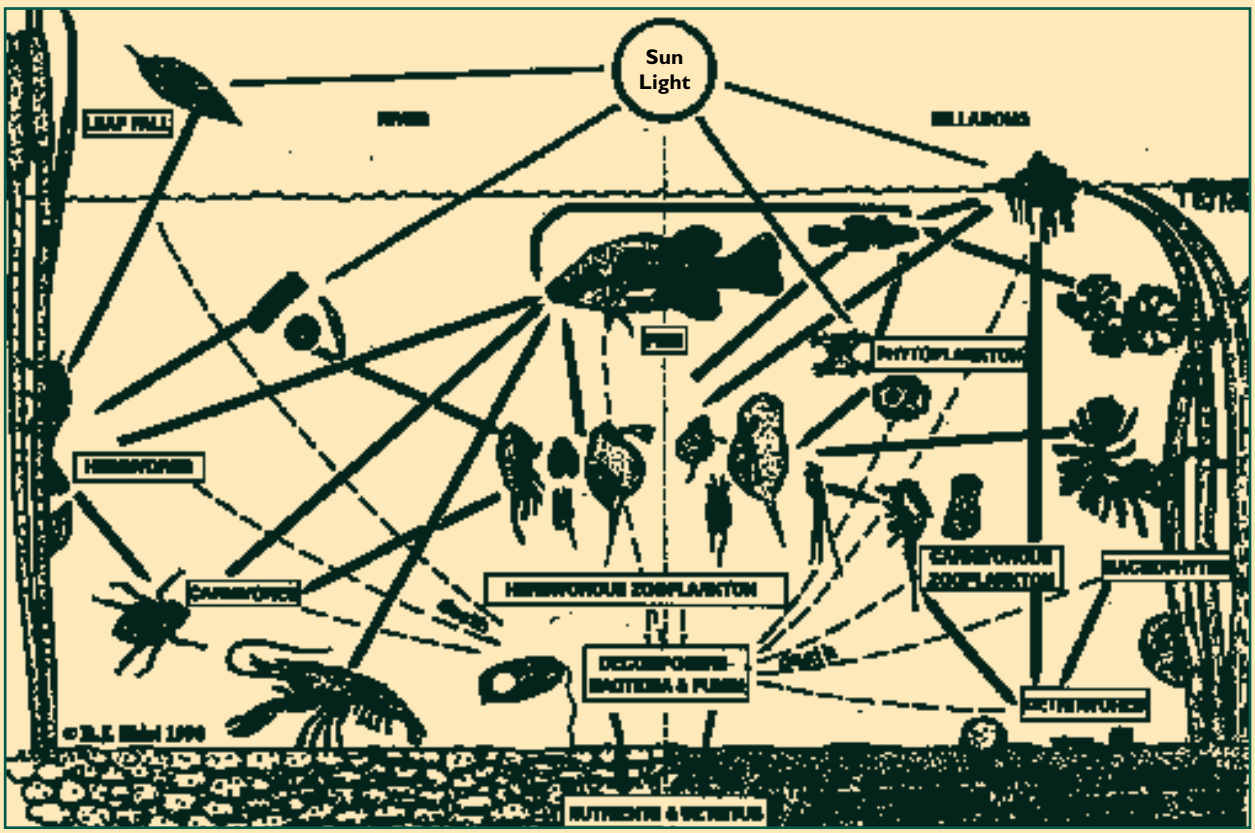
Modern Australians have expended enormous efforts to create a Northern Hemisphere-like river system in the midst of outback Australia. The Murray-Darling Basin's irrigation infrastructure alone has been estimated to be worth $30 billion, and is added to each year. In economic terms, the investment appears to have paid off. Northern Hemisphere-style agriculture, industry and lifestyles now prosper in the Basin, returning an estimated $10 billion to the Australian economy each year.

However, this wealth depends on the services provided by the native river system as much as it does on modern water engineering, and often the two are in direct conflict. The Murray-Darling drainage system is now made up of two different types of river trying to run in the same bed. New, regulated and predictable rivers, populated with introduced species and hemmed in by artificial dams and levees, share the same channels with much older, wilder and less predictable rivers. After some 150 years of wrestling with each other for primacy, both new and old river systems are now worn out. Both are in crisis.

Somehow Australians must make this hybrid system work. Somehow we must conserve the all-important natural processes of our inland river floodplains, while also supplying humans and industry with the water and services they have come to need.

Billabongs are home to a teeming diversity of life and contain between 100 and 1000 times more species than the rivers that flow past them.

A simplified food web in a billabong



Russell Shiel